Uva Wellassa University, Sri Lanka
End Semester Examination – March 2011
SCT 312-3 Breeding & Genetics

Time: Three (03) hours

Total **Seven (07)** Questions
Answer **Two (02)** questions from **Part A** including the question number **One (01)** and **Three (03) questions** from **Part B** including the question number **Seven (07)**.

Part A

1.

a) How you can synthesis a DNA sequence form the m-RNA sequence? (4marks)

b) A group of scientists at "Gene Tech" institution is studying about a specific gene (DT_1) of a particular marine plant. Therefore, they have isolated and sequenced that particular gene. They have identified that "GCT" sequences of that gene represent introns. A part of the anti sense strand of that gene is as follows.

5' ACTGCTTTAGGGCTCTAGCTGCAAAGTCAGCT 3'

i) Write down the sense strand and the possible m-RNA strands. (4marks)

ii) What are the possible polypeptide sequences which can be derived from the m-RNA sequences? (3 marks)

c) DTZ_1 is a **very rare** plant which can only be found in Kanneliya natural forest in Sri Lanka. A Group of university students is trying to find out the sequence of a particular gene which is responsible for the flower colour of this plant. Imagine that you have only one plant to find out the sequence.

i) Propose a method to preserve the total genetic makeup of this plant. (Assume that tissue culture facilities are not provided) (4 marks)

ii)Briefly state the major steps to isolate that gene. (imagine that the gene quality is very poor) (5 marks)

2.

a) Following results were obtained for a cross between two *Pisum sativum* plants.

64 tall plants with the genotype TT

32 tall plants with the genotype Tt

04 dwarf plants with the genotype tt

i) Calculate the genotype frequency for Dwarf plats (2marks)

ii) Calculate the allele frequency for T and t (5marks)

iii) Calculate the genotype frequency for heterozygous plants (3marks)

b) A diploid *Lemna sp* plant has 2n=10 chromosomes and approximately 1.6 X 10^{10} bp of DNA. How much DNA is in a nucleus of a *Lemna* sp plant cell at

i) Mitotic metaphase ii) Meiotic metaphase I

iii) Mitotic telophase iv) Meiotic telophase II

(4 marks)

c) Briefly explain how RNA duplex is formed (use suitable diagrams) (6 marks)

3. Following description is based on coat colour of mice.

a) Normal wild type coat colour is agouti, a grayish pattern is formed by alternating bands of pigment on each hair. Agouti is dominant to black (non agouti) hair, which is caused by a recessive mutation, (a). Thus (A) results in agouti, while (aa) yields black coat colour. When it is homozygous, a recessive mutation, (b), at a separate locus, eliminates pigmentation altogether, yielding albino mice (bb), regardless of the genotype at the other locus.

A cross is made between albino mice and black colour mice and F1 Phenotypic ratios are as follows.

1/4 agouti, 1/4 black, 1/2 albino

Note: gene A represents the coat colour of mice.

i) What is the genetic basis of this incident (2marks)

ii) Find the genotypes of F1 generation (mention all the steps) (6marks)

b) A group of scientists wanted to design an experiment related to the inheritance of body colour of mammalians. Therefore, the black colour mouse of F1 generation was crossed with agouti mouse. Find the possible genotypic ratio of this cross. (5 marks)

c) Certain genetic abnormality expresses by having an autosomal dominant allele. Abnormal woman get married to a man who is not abnormal and from that marriage they get two offsprings. The first offspring is a female who is not expressing the abnormal condition. That normal female get married to an abnormal man and their first abnormal female offspring get married to a abnormal man and they got two monozygotic offsprings both having abnormal condition.

i) Draw the pedigree and find the genotypes. (5 marks)

ii) What is the probability of having normal male offspring in progeny three? (2marks)

Part B

4. Write short notes on any three of the following

a) Gene mutations

b) Inbreeding depression

c) Artificial selection in plant breeding

d) Linkage and Linkage drag

(20 marks)

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5.

a) Define gene mutation (2.5 marks)

b) What are the artificial mutagenic agents used in mutation breeding programs? (2.5 marks)

c) Explain the major steps in a mutation breeding program with seed as the starting material. (10 marks)

d) What is the significance of mutation breeding? (05 marks)

6.

a) What are polyploids? (2.5 marks)

b) Briefly describe how natural polyploids are created? (10 marks)

c) Explain how polyploidy is induced artificially? (2.5 marks)

d) Why polyploids are important in plant breeding? (05 marks)

7.

a) Mark by shading the relevant area in the world map below, the centres of origin of the following crops

i) Corn

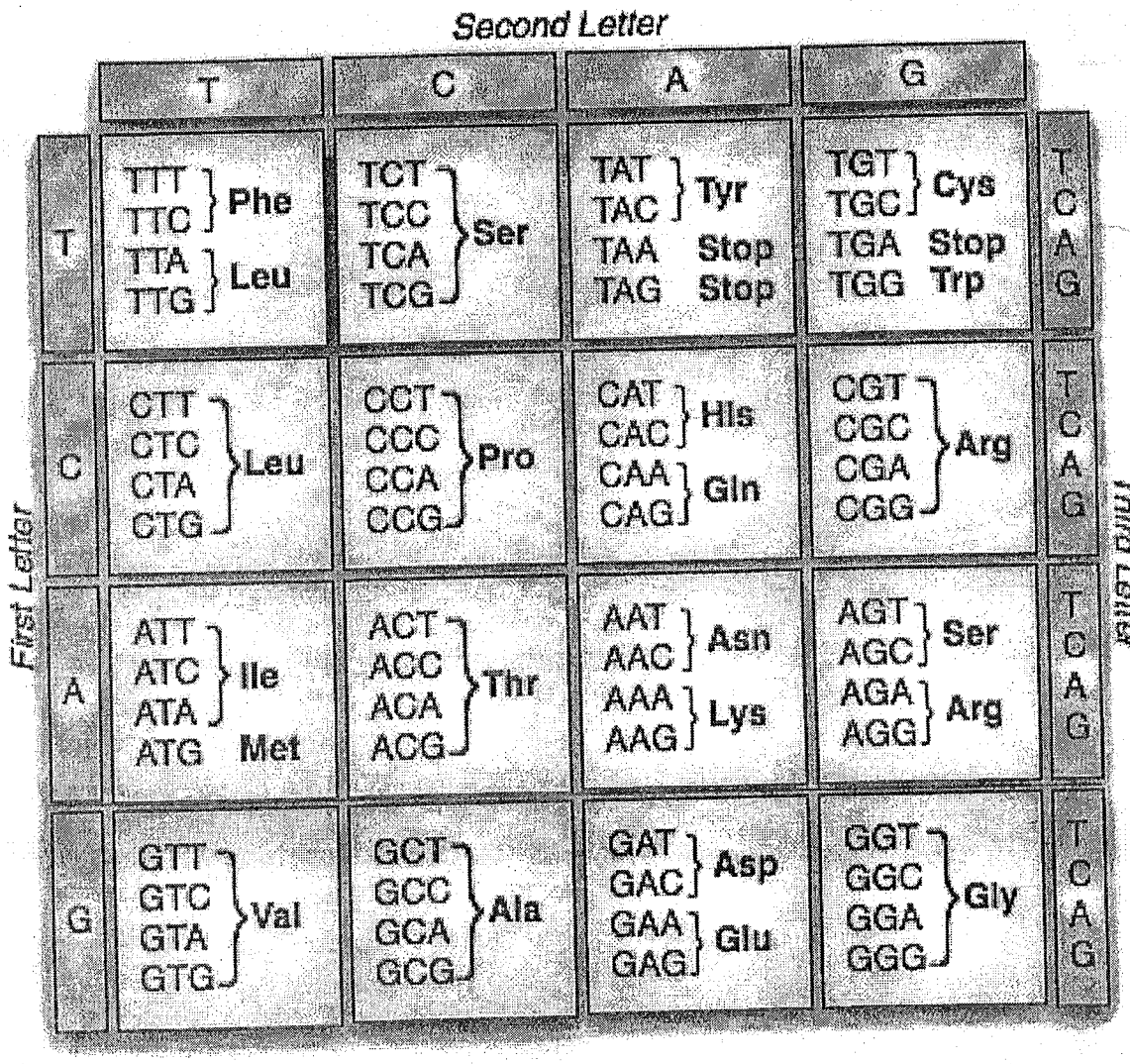
ii) Soybean

iii) Wheat

iv) Potato

v) Sugar cane (10 marks)

b) What were the important plant traits in early domestication? (10 marks)


Second Letter
T
C
A
G
First Letter
Third Letter
T
C
A
G
TTT TTC Phe
TTA TTG Leu
TCT TCC TCA TCG Ser
TAT TAC Tyr
TAA Stop
TAG Stop
TGT TGC Cys
TGA Stop
TGG Trp
CTT CTC CTA CTG Leu
CCT CCC CCA CCG Pro
CAT CAC His
CAA CAG Gln
CGT CGC CGA CGG Arg
ATT ATC ATA Ile
ATG Met
ACT ACC ACA ACG Thr
AAT AAC Asn
AAA AAG Lys
AGT AGC Ser
AGA AGG Arg
GTT GTC GTA GTG Val
GCT GCC GCA GCG Ala
GAT GAC Asp
GAA GAG Glu
GGT GGC GGA GGG Gly